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**Evolution with Neutrino Loss of a Massive Star until the Onset of Carbon Burning.** CHUSHIRO HAYASHI AND ROBERT C. CAMERON, *Kyoto University and Goddard Space Flight Center*.—Previously the authors pointed out [*Astron. J.* **67**, 577, 1962; see also, Hayashi, C., Hoshi, R., and Sugimoto, D. *Progr. Theoret. Phys. Suppl.* (*Kyoto*), No. 22, 1, 1962] that, assuming energy loss due to the universal Fermi interaction between electrons and neutrinos, the lifetime of a star of 15.6 solar masses as a red supergiant (post-helium-exhaustion phases) will be too short to account for the observed number of such stars in the cluster h and $\chi$ Persei. The neutrino loss effect after the formation of a carbon–oxygen core has now been studied in detail by constructing a contracting-core model sequence. The hydrogen-rich envelope and a helium zone are neglected and the core is treated as a single star of 2.6 solar masses. As the contraction proceeds, a central isothermal core appears; its mass grows because of the rather high temperature dependence of the neutrino-loss rate. In the outer zone of lower temperature, the energy release (radiation loss) is due mainly to gravitational contraction, with the rate proportional to the temperature. Partial degeneracy and relativistic effects are included in the isothermal core computations.

Fitting of the core and outer zone (accomplished by equating neutrino and radiation loss rates) shows that electron degeneracy sets in at the center when the mass of the core becomes about one-half solar mass; subsequently, the degenerate region grows somewhat rapidly with increasing temperature and density. When the core mass becomes about one solar mass, both the central density and temperature become high enough for the carbon flash to occur. The outer boundary of the isothermal core is always nondegenerate. Thus, neither the Schönberg–Chandrasekhar limit for a nondegenerate isothermal core, nor the Chandrasekhar limit for a degenerate configuration gives the critical stage for the contracting carbon–oxygen core.

The lifetime of the contraction phase up to the onset of the carbon flash is not much different from our previous estimate, since it is determined essentially by the rate of gravitational contraction in the nondegenerate region.